Via Po, 53 – 10124 Torino (Italy)
Tel. (+39) 011 6704043 - Fax (+39) 011 6703895
URL: http//www.de.unito.it

WORKING PAPER SERIES

ECONOMIC OPENNESS, SKILL DEMAND AND SKILL SUPPLY IN THREE ARCHETYPES OF DEVELOPING COUNTRIES: A THEORETICAL AND EMPIRICAL INVESTIGATION

Donatella Saccone

Dipartimento di Economia “S. Cognetti de Martiis”

Working paper No. 13/2008

Università di Torino

Preliminary draft

Economic openness, skill demand and skill supply in three archetypes of developing countries: a theoretical and empirical investigation.

Donatella Saccone

October, 2008

Key words: Inequality; Education; Economic Development; Economic Openness

JEL Classification: D63; I21; J24; O15

1. Introduction

There are several channels by which economic openness can act on the income distribution. This statement seems much clearer when we think that economic openness is a multi-dimensional phenomenon; in fact, by using this word, we generally refer to trade liberalization, financial openness, FDI flows and even to a larger range of liberalization policy inspired to the so-called Washington Consensus.

First of all, economic openness can act on the labor market by modifying both wages and employment possibilities. However this is not the only channel by which economic openness can alter the income distribution. For example this process can also act on the production localization and then on regional inequalities; on agricultural production and prices; on financial markets; on the governmental capacity to redistribute.

For these reasons it is difficult to theoretically model the relationship between economic openness and income inequalities; in fact it is quite impossible to build a model taking into account all the channels listed above. The inclusion of every single element is actually possible only when we are dealing with this issue in a general way, but it has to be excluded when we move to a theoretical formalization. This is confirmed by the fact that existing literature presents a number of theoretical works about each aspect of economic openness and its impact on income inequalities, but none including all of them in a single model[1].

However the impossibility of including in a single model the whole relationship between economic openness and income distribution cannot discourage us from dealing with this issue. Each theoretical analysis –even if partial- can contribute to understand how economic openness acts on inequalities from a particular perspective. Nevertheless, this has to be done by taking into account that the conclusions by each single model have to be carefully presented; in fact these conclusions regard some partial effects that could be counterbalanced by the action of economic openness through other channels; in other words, theoretical conclusions are reliable *ceteris paribus*.

In this paper we will propose a theoretical framework to analyze the issue from a particular perspective: we will focus on the impact of economic openness on the labor market and, in particular, on the skill demand variations and the skill supply reactions. Moreover we will emphasize the importance of country's education level in leading the direction of the economic openness impact on inequalities. Three main aspects of economic openness will be taken into account: trade liberalization, technological transfer from the North to the South, and FDI.

[1] See Anderson (2005) for e review of the literature dealing with the various channels by which economic openness acts on inequalities.

In the first paragraph, we will present a theoretical framework to study the impact of economic openness on the skill demand. Moreover, in the second paragraph, we will propose a model allowing to infer the skill supply evolution in response to the skill demand changes; in particular, we will try to understand the impact of this evolution on country's development level and under which conditions a country – given its initial characteristics- can achieve a 'development with equity' path. The model implications will not be presented for developing countries as a whole; it is unrealistic to think that economic openness has the same effect on a so large range of economies. On the contrary, we will consider three archetypes of developing countries, differentiated on the basis of education diffusion. It is again necessary to underline that these implications will be the outcome of an analysis carried out from a particular perspective and, then, they will be partial and reliable merely *ceteris paribus*. Finally in the third paragraph we will empirically verify whether and in which measure country's education level can modify the impact of economic openness on inequalities; we will carry out a cross-country analysis over the period 1980-2000 by taking into account 60 developing countries.

2. Economic openness and skill demand.

Two different approaches have been used to explain relative wages movements: on the one hand, some economists focused on the 'trade' explanation based on the comparative advantage concept and the HOS theorem; on the other hand, there were those who preferred to explain these changes by theories about technology and skill-biased technological change. However, as Robbins underlined, following a process of economic openness it is likely that these two factors jointly act on relative wages, often in an opposite direction[2].

The framework that we will present is characterized by three main elements. First of all we will try to achieve a synthesis between these two approaches, by taking into account both 'trade' and 'technology' effects. We will underline the importance of considering not only the relative but also the absolute endowments of production factors; this is the element that will differentiate the way by which the two effects act. Indeed, while the previous research gave the highest importance to relative endowments to analyze the 'trade' effect, we cannot completely understand the outcomes of economic openness unless we also consider the absolute ones. In particular, we have to look at the absolute skill endowment of the country involved in this process; we can define it as the stock of 'social capabilities' by recalling the expression used by Abramovitz[3]. This is highly important in

[2] Robbins (1996).
[3] Abramovitz (1986).

order to understand how and under which circumstances economic openness can give rise to a process of technological change in developing countries and then modify relative wages.

Moreover, we will take into account three different types of labor, by following Wood's classification; Wood identified the minimum number of skills to take into account in the contemporary economy:

"*Although skill can be conceptualised and applied as a continuous variable, it is often convenient to divide the labour force into a small number of distinct skill categories. To understand North-South trade and labour markets, a minimum of three skill categories appears to be essential.*"[4]

These categories are: unskilled labor without skills and characterized by the lack of education; medium-skilled labor with a basic level of education but a middle-low level of specialization; skilled labor, distinguished by its high degree of education and specialization. Although Wood used this classification referring to the within-country labor market, we will also reproduce it across-country to distinguish the three economies on the basis of their absolute and relative endowment of skills.

The third element characterizing our analysis is based on the necessity to take into account the classification illustrated above. In fact, in order to follow this labor classification, we have to introduce some simplifications making the model solvable. Following some models dealing with the relationship between trade liberalization and skill supply, we will not adopt the traditional production function using capital and labor as production factors[5]; we will exclusively focus on this last factor by abstracting from capital. Although this is a strong simplification, it gives some advantages: it allows us to go deep into the analysis of the impact of 'trade' and 'technology' not on the labor as a whole, but rather on labor characterized on the basis of its skill intensity. In other words, the price paid to go deeper into the specific is to simplify the general.

2.1. The general model.

Consider an economy in which there are two sectors, L (low tech) and H (high tech), but three production factors, i.e. three types of labor: unskilled without education (U), medium skilled with a basic level of education (M) and highly skilled with a high level of education (S). The first

[4] Wood (1994), p.48.
[5] Among these models see Findlay and Kierzkowski (1983), Fischer and Serra (1996), Davis and Reeve (2000), Kim and Kim (2000), Ranjan (2001), Chesnokova and Krishna (2004), Das (2006). Moreover, see Acemoglu (2001) in the literature about technological change and labor market.

sector, L, combines the first two types of labor, whereas the second sector, H, uses S. A_{lt} and A_{ht} represent the technological efficiency of the two sectors; A_{lt} and $A_{ht} \geq 1$. For the sake of simplicity, we assume that production functions are in the following form:

$$Y_{lt} = A_{lt} U_t^{\alpha} M_t^{1-\alpha}$$
$$Y_{ht} = A_{ht} S_t$$

where $0 \leq \alpha \leq 1$.

Moreover assume that there is perfect competition in good and factor markets. Normalizing the price of the good produced by the high tech sector to one, the three wages in equilibrium are:

$$w_u = p\alpha A_l \left(\frac{M}{U}\right)^{1-\alpha}$$

$$w_m = p(1-\alpha) A_l \left(\frac{U}{M}\right)^{\alpha}$$

$$w_s = A_h,$$

where p represents the relative price of the good produced in the sector L.

Relative wages are:

$$\frac{w_m}{w_u} = \left(\frac{1-\alpha}{\alpha}\right)\frac{U}{M}$$

$$\frac{w_s}{w_u} = \frac{1}{p}\frac{A_h}{A_l}\frac{1}{\alpha}\left(\frac{U}{M}\right)^{1-\alpha}$$

$$\frac{w_s}{w_m} = \frac{1}{p}\frac{A_h}{A_l}\left(\frac{1}{1-\alpha}\right)\left(\frac{M}{U}\right)^{\alpha}.$$

In this way, the 'trade' effect on relative wages is typified by the changes of the relative price of the good produced by the sector L; following traditional trade theories, this effect depends on country's relative endowments of production factors.

On the contrary, the 'technology' effect can be studied by looking at variations of the efficiency parameters, A_{lt} and A_{ht}, and of α; this last expresses how much unskilled labor contributes to produce Y_l. Unlike the 'trade' effect, the 'technology' effect depends on absolute endowments of production factors. Call M* the threshold of medium-educated labor necessary so that a country can transfer and absorb medium-skill-intensive technologies from the North, and S* the stock of highly-educated labor above which a country has the capability to use high-skill-intensive technologies. It is clear that economic openness makes easier to transfer technologies from the North to the South; however, this transfer will take place only if the country has the required stock of social capabilities, i.e. if $M_i > M^*$ and/or $S_i > S^*$.

Assume that the transfer of high-skill-intensive technologies expands the efficiency of the sector H by increasing A_h. On the contrary, assume that the transfer of medium-skill-intensive technologies has two different effects: on the one hand, it improve the efficiency of the sector L (A_l increases); on the other hand, because of the medium-skill-biased, it causes a technological change damaging unskilled labor (α decreases).

2.2. A more differentiated framework.

Alternatively consider the case of three developing economies that open to the rest of the world; assume that in this latter are included developed and already 'globalized' countries. These three economies differ on the basis of their absolute and relative levels of education. The three archetypes of developing countries are then characterized in the following way:

- First archetype: this economy presents a very low average level of education and a high illiteracy rate; most people either have no education or have primary education, whereas secondary and tertiary education are scarcely spread and concentrated in few individuals belonging to the upper part of income distribution. This is likely to be a low income economy presenting a low level of development and lacking also in the basis for the existence and maintenance of human capital (high infantile mortality, low life expectancy, insufficient health infrastructures etc.). Moreover, the agricultural sector is likely to be still relatively important with respect to the other sectors. Some Sub-Saharian African countries, for example, belong to this category.
- Second archetype: the country is characterized by a still significant illiteracy rate for poorer people but also by the diffusion of basic education (primary and/or secondary); therefore there is a large but not equally distributed presence of basic education and

scarcity of skilled labor with technical and advanced education. This country is likely to belong to the middle-income group and to be already on the path of industrial development. Its characteristics make it similar to some economies of Latin America.

- Third archetype: it presents an even distribution of primary and secondary education and a large diffusion of tertiary and technical education (not only educated but also highly specialized labor). Middle or upper-middle income countries are its reference group and some East Asian countries are similar to this archetype.

Obviously it could be misleading to think that the effect of economic integration is unique for all the three economies. Therefore, analyzing how we expect skill demand behaves in each of the three economies following the economic openness, the increase of trade volumes and the potential transfer of technologies and FDI, the model suggests that the effects of economic openness on skill demand – *ceteris paribus*- are different in each country depending not only on the relative skill endowment but also on economy's stock of 'social capabilities'. In particular, when the possibility of technological transfer via trade and FDI is also considered, the HOS theorem is no longer appropriate and it is necessary to distinguish developing countries among them. In this way, the outcome of economic openness depends on characteristics often working in an opposite direction. As a consequence, the result is not unique for all developing countries; on the contrary, it differs in each case depending on the relative force of 'trade' and 'technology' effects.

3. Economic openness and skill supply.

In the following part we will try to address some issues: which are the skill supply dynamics in response to economic openness? Which are the effects of this process on country's development level through skill supply variations? Is it possible for a country –given its initial characteristics- to go up in the scale of considered archetypes and reach 'development with equity'? We will try to address these issues by building a theoretical framework to study how economic openness can modify individuals' choices of investing in education.

The model that we will adopt was proposed by Owen[6]. However it was featured with some elements that we will modify to make the study consistent with our analysis:

a) Owen's work started from the standard HOS with two sectors and two factors (skilled and unskilled labor): economic openness causes unskilled workers' relative wage to increase.

[6] Owen (1999).

On the contrary, we will start from the model and results showed in the previous paragraph.

b) In Owen's model individuals have two chances: investing or not in education for their child. Since we included three types of labor in the previous part, we will consider three possible chances: no education, basic education or high education for their child.
c) Owen studied implications for developing countries as a whole; on the contrary, we will study the skill supply dynamics distinctly for each archetype.

3.1. The model.

In the following part we will present the core of the theoretical model that we built. Consider individuals differing in their ability and living for two periods in overlapping generations. In the first period they can accumulate skills depending on decisions of their parents; their parents have three chances:

- investing in basic education for their child supporting the cost $\overline{m}$
- investing in high education for their child supporting the cost $\overline{m} + \overline{h} = \overline{s}$
- not investing in education for their child.

In the second period of life, individuals supply $a_{i,t}$ unit of unskilled, medium-skilled or high-skilled labor, where $a_{i,t}$ represents the ability of individual *i* at time *t*. Following Owen, call $\psi(a)$ the distribution of ability and assume it time-invariant and having both a lower and an upper bound: $\overline{a}, \underline{a} > 0$, while $E(a) = 1$. Moreover in the second period individuals consume and decide to invest or not in child education.

Owen assumed imperfect credit market prohibiting educational loans; in this way, in the second period individuals' wages depend on funds provided by their parents in the first period of life. In other words, the income of individual *i* in the second period is:

$$y_{i,t+1} = \begin{cases} a_{i,t+1} w_{u,t+1} & \text{if parents didnt' invest in individual i's education} \\ a_{i,t+1} w_{m,t+1} & \text{if parents invested } \overline{\text{m}} \text{ in individual i's education} \\ a_{i,t+1} w_{s,t+1} & \text{if parents invested } \overline{\text{s}} \text{ in individual i's education} \end{cases}$$

where $a_{i,t+1}$ represents the ability of

individual *i* at time *t+1*, while w_u, w_m and w_s respectively are unskilled, medium-skilled and high-skilled workers' wages.

In Owen's model individuals' utility depends not only on consumption but also on expected income of their child. For the sake of simplicity, Owen assumed that the ability is not revealed until individuals become adults and, then, $E(a_{i,t+1}) \equiv 1$; as consequence parents' utility depends on expected income of their child $E(y_{i,t+2})$. The utility function for individual *i* born at time *t* is:

$$U = \alpha \ln(l_{t+1}) + \beta \ln(h_{t+1}) + (1-\alpha-\beta)\ln(E[y_{t+2}]),$$

where l_{t+1} is the consumed quantity of the good *l*, h_{t+1} the consumed quantity of the good *h*, y_{t+2} the child's income, $\alpha, \beta \in (0,1)$ and $1-\alpha-\beta > 0$. Normalizing to one the price of the good *h* and calling p_t the relative price of l_t, individuals maximize their utility subject to the following constraints.

If the child is uneducated:

i. $w_{u,t+2} = E(y_{t+2})$

ii. $p_{t+1} l_{t+1} + h_{t+1} \leq y_{t+1}$,

if the child receives basic education:

i. $w_{m,t+2} = E(y_{t+2})$

ii. $p_{t+1} l_{t+1} + h_{t+1} \leq y_{t+1} - \overline{m}$,

if the child receives high education:

i. $w_{s,t+2} = E(y_{t+2})$

ii. $p_{t+1} l_{t+1} + h_{t+1} \leq y_{t+1} - \overline{s}$.

We can now derive the equilibrium values for l_t and h_t:

$$l_t = \begin{cases} \dfrac{\alpha y_t}{p_t(\alpha+\beta)} & \text{when } y_t \le y_t^* \\ \dfrac{\alpha\left(y_t - \overline{m}\right)}{p_t(\alpha+\beta)} & \text{when } y_t^* < y_t \le y_t^\circ \\ \dfrac{\alpha\left(y_t - \overline{s}\right)}{p_t(\alpha+\beta)} & \text{when } y_t > y_t^\circ \end{cases} \quad h_t = \begin{cases} \dfrac{\beta y_t}{(\alpha+\beta)} & \text{when } y_t \le y_t^* \\ \dfrac{\beta\left(y_t - \overline{m}\right)}{(\alpha+\beta)} & \text{when } y_t^* < y_t \le y_t^\circ \\ \dfrac{\beta\left(y_t - \overline{s}\right)}{(\alpha+\beta)} & \text{when } y_t > y_t^\circ \end{cases}$$

where:

$$y_t^* = \frac{\overline{m} w_{m,t+1}^{\varphi}}{w_{m,t+1}^{\varphi} - w_{u,t+1}^{\varphi}}; \qquad y_t^\circ = \frac{\overline{s} w_{s,t+1}^{\varphi}}{w_{s,t+1}^{\varphi} - w_{m,t+1}^{\varphi}}; \qquad \varphi \equiv \frac{1-\alpha-\beta}{\alpha+\beta}.$$

y_t^* is the threshold level of the parents' income above which they provide basic education for the child, while y_t° is the threshold level of the parents' income above which they provide high education for the child. At y_t^* utility of the parents providing basic education for the child is equal to utility of the parents providing no education for the child; similarly, at y_t° utility of the parents providing high education for the child is equal to utility of the parents providing basic education for the child. It is easy to see that y_t^* and y_t°, i.e. the two thresholds, go up with the increasing of corresponding education cost, while they go down with the increasing of incentives to education (depending on relative wages).

In this way, while in Owen's model there exist two types of family, in our model there are three types of them: families with income below y_t^*, providing no education for the child; families with income higher than y_t^* but lower than y_t°, providing basic education for the child; families with income above y_t°, providing high education for the child. Consequently, individuals' decisions related to child's education depend on:

- their income (income effect): *ceteris paribus*, a growth of a family's income increases the chances to provide education for the child;
- relative wages (incentive effect): *ceteris paribus*, when w_m / w_u goes up, the incentive of investing in basic education increases (y_t^* goes down); similarly, when w_s / w_m grows, the incentive of investing in high education increases (y_t° goes down);

- education cost (cost effect): *ceteris paribus*, a decrease of basic/high education cost increases the number of children receiving basic/high education.

This is the essential logic of our model. Economic openness can act jointly both on relative (incentive effect) and absolute (income effect) wages, as we can see in the part dealing with the skill demand; then, we can see how economic openness modifies the skill supply by studying the direction of incentive and income effects after this process. Obviously, these two effects can also have an opposite direction.

In general, this study stimulates some reflections. First of all, the effects of economic openness on inequalities are no longer sure and unambiguous when we consider the differences between countries and allow the skill supply to react to changes caused by this process; the effects of economic openness actually differ both spatially – depending on countries' characteristics- and temporally – from short to long term. Moreover, in each country these effects are different depending on policy coupling economic openness. In none of the three archetypes can the process of 'development with equity' spontaneously take place; on the contrary, even if there are all the necessary conditions (third archetype), it must be stimulated by complementary policy making the education diffusion easier, above all for those people otherwise excluded from new possibilities.

4. An empirical investigation: does education matter?

From the theoretical analysis we saw how economy's skill endowment influences the direction of the economic openness impact on income distribution; in the following part we will try to empirically investigate whether country's education level can interact with economic openness and also indirectly modify its effects in the reality.

We will carry out a cross-country analysis by using an unbalanced panel of 60 developing countries in the period 1980-2000; observations are at five-year intervals. Carrying out an empirical analysis in a so large sample of countries is particularly important in our case. In the theoretical part we distinguished developing countries by using three archetypes; however we have also to underline that developing countries actually are a continuum of characteristics and the average level of education is a continuous variable. A cross-country analysis then allows us to jointly treat countries presenting different characteristics and education levels without appealing to theoretical categorization.

The basic equation that we will estimate is the following:

$$Gini_{i,t} = \beta_{o,i} + \beta_2 PCI_{i,t} + \beta_3 HC_{i,t} + \beta_4 UNEMPL_{i,t} + \beta_5 OPEN_{i,t} + \beta_6 \left(OPEN_{i,t} * HC_{i,t}\right) + \beta_7 FDI_{i,t} + \\ + \beta_8 \left(FDI_{i,t} * HC_{i,t}\right) + \varepsilon_{i,t}$$

where:

$Gini_{i,t}$ = Gini coefficient of the country i at time t (source: GHND, *Globalization-Health Nexus Database*)[7].

$PCI_{i,t}$ = PPP per-capita income of the country i at time t (source: GHND).

$HC_{i,t}$ = human capital diffusion measured by the average years of education of the country i at time t (source: Barro-Lee dataset)[8].

$UNEMPL_{i,t}$ = unemployment rate of the country i at time t (source: GHND).

$OPEN_{i,t}$ = economic openness of the country i at time t, alternatively expressed by trade volumes (import + export), exports and imports; each variable is measured as a share of GDP (source: WDI, World Development Indicators)[9].

$OPEN_{i,t} * HC_{i,t}$ = interaction variable between economic openness and education diffusion.

$FDI_{i,t}$ = foreign direct investments as a share of GDP (source: GHND).

$FDI_{i,t} * HC_{i,t}$ = interaction variable between foreign direct investments and education diffusion.

In the table 1 we show the results obtained by using the fixed-effect method. Moreover we also tested the robustness of the results by using the first-difference method; results obtained by this latter method are not qualitatively altered.

The first column reports the results of the basic model, obtained by measuring economic openness by the total trade volume (import + export) as a share of GDP. First of all we notice that the per-capita GDP coefficient is not significant and has a very low value; this means that this variable doesn't significantly influence inequalities. Also the coefficient of the average years of education is not significant, but its value is high and positive. The coefficient of unemployment rate is significant and positive.

[7] The database was elaborated by Cornia, Rosignoli and Tiberti (University of Florence) and it is available on the site www.dse.unifi.it/sviluppo/GHND.html .

[8] Barro and Lee (2000). Data are available on the site www.cid.harvard.edu/ciddata/ciddata.html .

[9] www.worldbank.org

Table 1: Results of fixed-effect regressions. Dependent variable: Gini coefficient.

	(1)	(2)	(3)	(4)	(5)	(6)
PCI	-0.0001414 (-0.46)	-0.0003677 (-1.17)	-0.0001651 (-0.55)	-0.0003764 (-1.23)	-0.0001042 (-0.33)	-0.0003306 (-1.03)
HC	1.2441281 (1.59)	2.5903477 (2.50) *	1.5410784 (1.98) *	2.7670416 (2.81) **	0.82920922 (1.08)	2.0355804 (1.93)
UNEMPL	0.3197281 (3.15) **	0.30421989 (3.05) **	0.34664012 (3.46) ***	0.33209998 (3.36) **	0.30678876 (2.99) **	0.28944796 (2.86) **
OPEN	13.67805 (2.28) *	15.48281 (2.38) *	35.39011 (3.14) **	37.11108 (3.16) **	14.58137 (1.24)	17.52028 (1.33)
OPEN*HC	-1.782834 (-2.05) *	-2.048991 (-2.23) *	-4.367528 (-2.62) **	-4.660379 (-2.74) **	-2.133131 (-1.26)	-2.575975 (-1.40)
FDI	-1.6284176 (-3.15) **	-1.2971338 (-2.46) *	-1.5584648 (-3.13) **	-1.2240618 (-2.40) *	-1.5536471 (-2.90) **	-1.2253962 (-2.24) *
FDI*HC	0.34006947 (3.89) ***	0.29766836 (3.38) ***	0.32599268 (3.83) ***	0.282998 (3.30) **	0.33061474 (3.69) ***	0.28775435 (3.18) **
IMR		0.12650805 (2.45) *		0.11942296 (2.39) *		0.12090362 (2.26) *
LEB		0.30303244 (2.13) *		0.28014063 (2.00) *		0.33021294 (2.29) *
Prob > F	0.00	0.00	0.00	0.00	0.00	0.00
R^2 ***within*** ***between*** ***overall***	 0.2641 0.0023 0.0199	 0.3026 0.0004 0.0086	 0.2938 0.0257 0.0451	 0.3281 0.0195 0.0305	 0.2420 0.0018 0.0064	 0.2807 0.0099 0.0001
No. Obs.	185	185	185	185	185	185
No. Groups	60	60	60	60	60	60

Notes: Values of t statistics in brackets. *, ** and *** mean coefficients are significant respectively at 95%, 99% and 99.9%. In the column 1 and 2 the variable OPEN is measured by the sum of imports and exports as a GDP share; in the column 3 and 4 this variable is expressed by import volumes as a GDP share; in the column 5 and 6 it is measured by export volumes as a GDP share.

Table 2: Marginal effects of trade and FDI on the Gini coefficient.

	HC: 10° percentile (= 1.23)	HC: sample mean (= 4.27)	HC: 90° percentile (= 7.76)	**TURNING POINT**
OPEN	11.48338 * (2.28)	6.059055 * (2.10)	-0.1531756 (-0.06)	HC = 7.67
FDI	-1.209792 ** (-2.91)	-0.1751202 (-0.90)	1.009841 *** (4.19)	HC = 4.79

Notes: the variable OPEN is measured by the sum of imports and exports as a GDP share. Marginal effects are calculated by using estimates showed in the column 1 of the table 1. Values of t statistics in brackets. *, ** and *** mean coefficients are significant respectively at 95%, 99% and 99.9%.

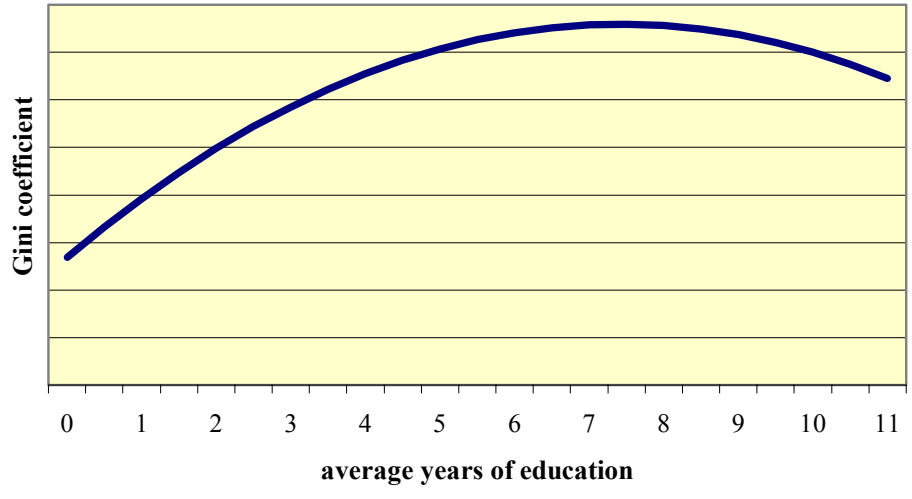
The coefficient of variables constituting our main object of study are all significant. Trade has a positive impact on the Gini coefficient; however when education spreads this effect is counterbalanced. The opposite is true for FDI. In order to understand the whole effect of trade and FDI we have to calculate the marginal effects (table 2). In our case they are given by:

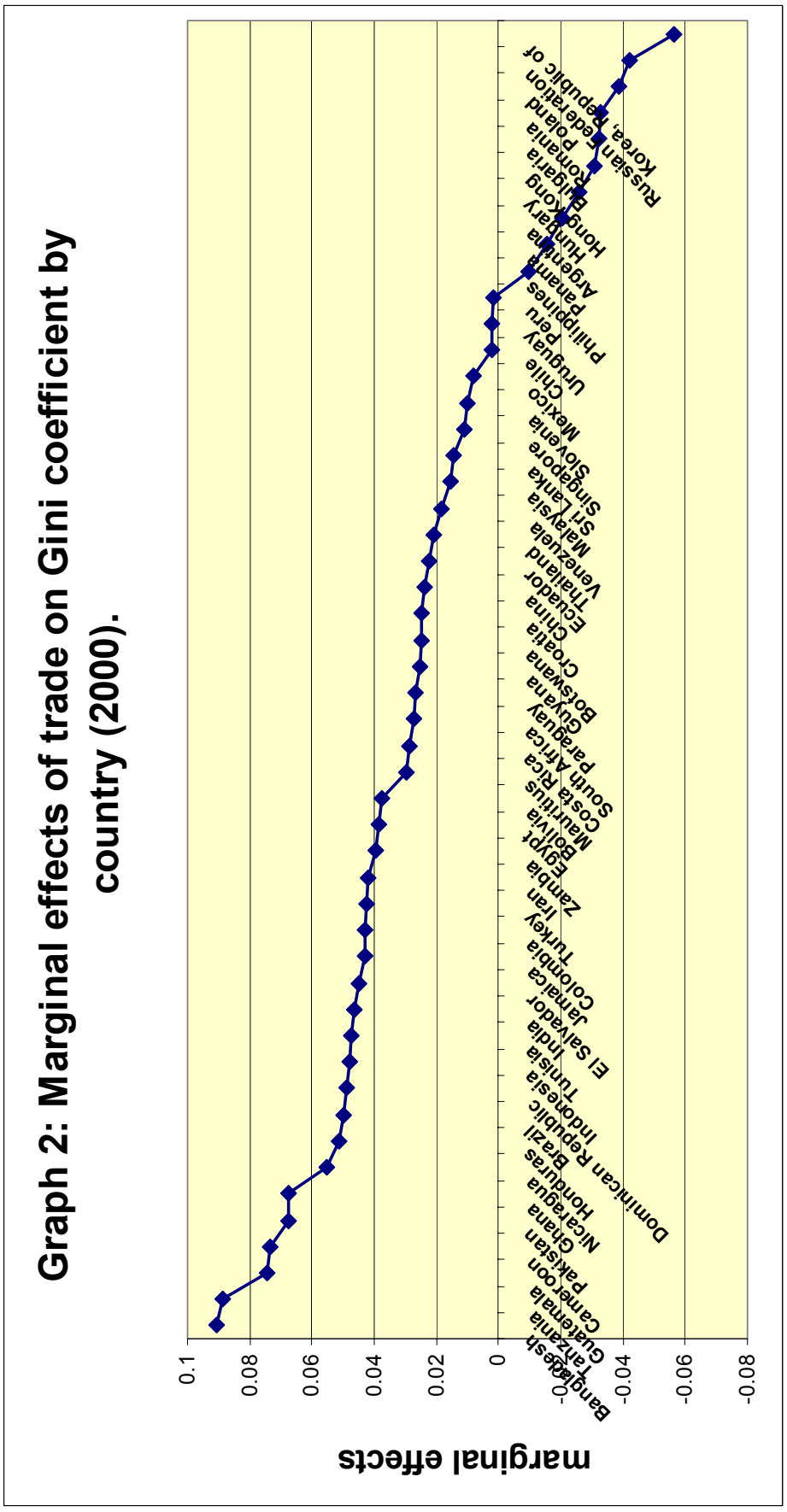
$$\frac{\partial GINI}{\partial OPEN} = \beta_5 + \beta_6 HC$$

$$\frac{\partial GINI}{\partial FDI} = \beta_7 + \beta_8 HC \ .$$

First of all, we notice that trade has an inverse-U effect on inequalities as average level of education grows. Indeed when this level is lower than 7.67 average years of education, trade increases inequalities; when average years of education reach a level of 7.76, there is the turning point and trade begins to decrease inequalities. This can be better understood by looking at the following graph. It represents the functional relationship between Gini coefficient and trade openness when the average years of education change.

Graph 1: Functional relationship between economic openness and Gini coefficient when the average years of education change.




Graph 2: Marginal effects of trade on Gini coefficient by country (2000).
marginal effects
0.1
0.08
0.06
0.04
0.02
0
-0.02
-0.04
-0.06
-0.08
Bangladesh
Tanzania
Guatemala
Cameroon
Pakistan
Ghana
Nicaragua
Honduras
Brazil
Dominican Republic
Indonesia
Tunisia
India
El Salvador
Jamaica
Colombia
Turkey
Iran
Zambia
Egypt
Bolivia
Mauritius
Costa Rica
South Africa
Paraguay
Guyana
Botswana
Croatia
China
Ecuador
Thailand
Venezuela
Malaysia
Sri Lanka
Singapore
Slovenia
Mexico
Chile
Uruguay
Peru
Philippines
Panama
Argentina
Hungary
Hong Kong
Bulgaria
Romania
Poland
Russian Federation
Korea, Republic of

Moreover in the graph 2 we have plotted the marginal effect of trade for each country included in the panel, by using the value of the variable HC in the 2000; this value ranges from 2.58 (Bangladesh) to 10.84 (South Korea). As we can see, few developing countries have an average level of education greater than the threshold above which trade decreases inequalities.
On the contrary, the marginal effect of FDI has a lower value and opposite sign with respect to the trade volumes. In this case, the turning point is at 4.79 average years of education.

Moreover, we repeated the previous regression by measuring the variable OPEN alternatively by imports (column 3) and exports (column 5) as a share of GDP. In addiction, we added to the three regressions other 2 explanatory variables (column 2, 4, 6): infantile mortality rate and life expectancy at birth. In all the regressions the previous results don't substantially change. The only result worth being quoted is that imports, rather than exports, seem to have a deeper impact on inequalities; indeed the coefficients of export are not significant. The greater effect of imports can be partially explained by the skill-enhancing trade (SET) hypothesis.

5. Conclusion.

Theoretical and empirical results of our analysis gave rise to some important reflections contributing to clarify the relationship between economic openness, education and income inequality.

First of all, the effects of economic openness on inequalities are no longer unambiguous when we consider the differences between countries and allow the skill supply to react to changes caused by this process. Previous studies indeed tried to determine the impact of economic openness in developing countries as a whole; however, the results of our analysis underlined the necessity to consider differences among countries because they can modify the impact of economic openness on income distribution. The effects of economic openness actually differ both spatially – depending on countries' characteristics- and temporally – from short to long term.

Moreover, in each country these effects are different depending on policy coupling economic openness. In none of the three archetypes can the process of 'development with equity' spontaneously take place; on the contrary, even if there are all the necessary conditions, it must be stimulated by complementary policy making the education diffusion easier, above all for those people otherwise excluded from new possibilities.

Finally, the cross-country analysis confirmed and strengthened the main hypothesis on which our theoretical analysis was based: education matters. In particular, it suggested that trade – above all through imports- has an inverse-U effect on inequalities as the average level of education

grows; when trade volume increases, inequalities worsen up to a threshold level of average years of education, beyond which they begin to decrease. The opposite is true for FDI: when economy' skill endowment is low they reduce inequalities but increase them as the average level of education grows.

References

ABRAMOVITZ M. (1986), *Catching Up, Forging Ahead, and Falling Behind*, in "The Journal of Economy History", Vol. 46, No.2, The Tasks of Economic History, p.385-406.

ACEMOGLU A. (2003a), *Factor Prices and Technical Change: From Induced Innovations to Recent Debates*, in Aghion P., Frydman R., Stiglitz J., Woodford M. (eds.), *Knowledge, Information and, Expectations in Modern Macroeconomics: In Honor of Edmund S. Phelps*, Princeton University Press.

ANDERSON E. (2005), *Openness and Inequality in Developing Countries: A Review of Theory and Recent Evidence*, in "World Development", Vol.33, No.7, p.1045-1063.

BARRO R.J., LEE J. (2000), *International Data on Educational Attainment: Updates and Implications*, CID Working Paper No. 42, Harvard University.

BERMAN E., MACHIN S. (2000a), *Skill-Biased Technology Transfer Around the World*, in "Oxford Review of Economic Policy", Vol.16, No.3, p.12-22.

BERMAN E., MACHIN S. (2000b), *Skill-Biased Technology Transfer. Evidence Factor Biased Technological Change in Developing Countries,* mimeograph, Boston University.

BERMAN E., MACHIN S. (2004), *Globalization, Skill-Biased Technological Change and Labour Demand*, in Lee E. and Vivarelli M. (eds.) (2004), *Understanding Globalization, Employment and Poverty Reduction*, Palgrave Macmillan, New York.

CHESNOKOVA T., KRISHNA K. (2004), *Skill Acquisition, Credit Constraints, and Trade*, University of Auckland, Pennsylvania State University e NBER.

DAS S.P. (2006), *Trade, Skill Acquisition and Distribution*, in "Journal of Development Economics", n. 81, pp. 118-141.

DAVIS D.R., REEVE T.A. (2000), *Human Capital, Unemployment, and Relative Wages in A Global Economy*, Board of Governors of the Federal Reserve System, International Finance Discussion Papers, No. 659.

ERNST D., LUNDVALL B. (1997), *Information Technology in The Learning Economy - Challenges for Developing Countries*, DRUID Working Paper No. 97-12.

FEENSTRA R.C., HANSON G.H. (1997), *Foreign Direct Investment and Relative Wages: Evidence from Mexico's Maquiladoras*, in "Journal of International Economics", No. 42, p.371-393.

FINDLAY R., KIERZKOWSKY H. (1983), *International Trade and Human Capital: A Simple General Equilibrium Model*, in "The Journal of Political Economy", vol. 91, n. 6, pp. 957-978.

FISCHER R.D., SERRA P.J (1996), *Income Convergence within and between Countries*, in "International Economic Review", vol. 37, n. 3, pp. 531-551.

GRIMALDA G., VIVARELLI M. (2004), *One or Many Kuznets Curves? Short and Long Run Effects of the Impact of Skill-Biased Technological Change On Income Inequality*, CSGR Working Paper No. 144/04.

HSIAO C. (2003), *Analysis of Panel Data*, Econometric Society Monographs, Cambridge University Press, Cambridge (UK).

KIM S., KIM Y.J. (2000), *Growth Gains from Trade and Education*, in "Journal of International Economics", No. 50, p. 519-545.

LEWIS W.A. (1954), *Economic Development With Unlimited Supplies of Labour*, in "The Manchester School", Vol. 22, No. 2, p. 139-191.

MAYER J. (2001), *Globalization, Technology Transfer, and Skill Accumulation in Low-Income Countries*, UNU/WIDER, Discussion Paper No. 2001/39.

OWEN A.L. (1999), *International Trade and the Accumulation of Human Capital*, in "Southern Economic Journal", vol. 66, n. 1, pp. 61-81.

RANJAN P. (2001), *Dynamic Evolution of Income Distribution and Credit-Constrained Human Capital Investment in Open Economies*, in "Journal of International Economics", n. 55, pp. 329-358.

ROBBINS D.J. (1996), *HOS Hits Facts: Facts Win; Evidence on Trade and Wages in the Developing World*, Harvard Institute for International Development, Development Discussion Paper No.557.

SANCHEZ-PARAMO C., SCHADY N. (2003), *Off and Running? Technology, Trade, and the Rising Demand for Skilled Workers in Latin America*, World Bank Policy Research Working Paper 3015, World Bank, Washington D.C..

SPIEZIA V. (2004), *Trade, Foreign Direct Investment and Employment: Some Empirical Evidence*, in Lee E. and Vivarelli M. (eds.) (2004), *Understanding Globalization, Employment and Poverty Reduction*, Palgrave Macmillan, New York.

WILLEM TE VELDE W.D., MORRISSEY O. (2002), *Foreign Direct Investment, Skills and Wage Inequality in East Asia*, Paper Presented at DESG Conference, April 2002, Nottingham.

WOOD A. (1994), *North-South Trade, Employment, and Inequality. Changing Fortunes in a Skill-Driven World*, Clarendon Press, Oxford.

WOOLDRIDGE J.M. (2002), *Econometric Analysis of Cross Section and Panel Data*, The MIT Press.